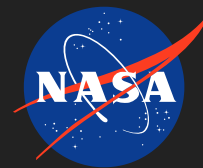


Molecular Dynamic Simulation of High Thermal Conductivity Synthetic Spider Silk for Thermal Management in Space

Completed Technology Project (2013 - 2017)



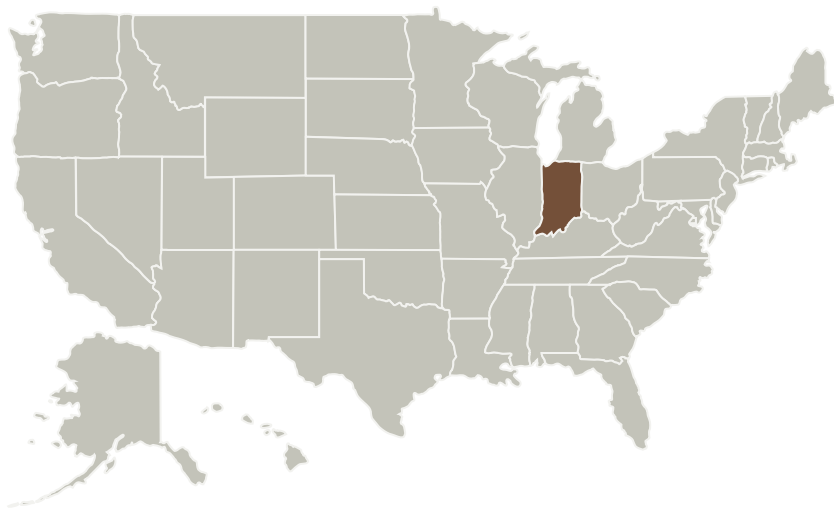
Project Introduction

Thermal management is crucial to space technology. Because electronic and other thermally sensitive materials will be located in an essentially airless environment, rejecting waste heat and maintaining thermal equilibrium between detached components becomes a limiting aspect to many space systems. Thermal links and other methods of maintaining isothermal conditions between discontinuous components are currently in use, however, the current technologies of metallic and carbon fiber thermal links suffer from high weight and low flexibility. This project will improve the current technology with genetically engineered synthetic spider silk that has the thermal conductivity of copper but superior flexibility, toughness, and strength. The thermal conductivity of natural spider silk is comparable to copper; however synthetic spider silk is yet to be developed to a similar high conductivity level. In order to optimize the fiber microstructure for high thermal conductivity, a fundamental understanding of the molecular-scale heat transfer in spider silk is required. The goal of this project is to develop a high conductivity synthetic spider silk as a thermal management material. The focus of my research is to use molecular dynamics to simulate the heat transfer in synthetic spider silks of different molecular structure to guide the selection of protein structures to optimize the thermal properties of the silk.

Anticipated Benefits

This project will improve the current technology with genetically engineered synthetic spider silk that has the thermal conductivity of copper but superior flexibility, toughness, and strength.

Primary U.S. Work Locations and Key Partners



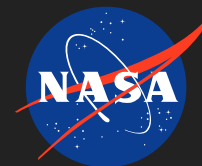
Molecular Dynamic Simulation of High Thermal Conductivity Synthetic Spider Silk for Thermal Management in Space

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	1
Project Website:	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destination	3

Molecular Dynamic Simulation of High Thermal Conductivity Synthetic Spider Silk for Thermal Management in Space

Completed Technology Project (2013 - 2017)



Organizations Performing Work	Role	Type	Location
Purdue University-Main Campus	Lead Organization	Academia	West Lafayette, Indiana

Primary U.S. Work Locations
Indiana

Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Purdue University-Main Campus

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

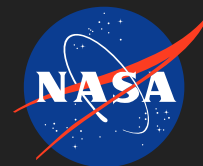
Suresh Garimella

Co-Investigator:

Karen N Son

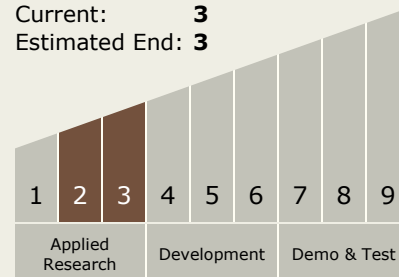
Molecular Dynamic Simulation of High Thermal Conductivity Synthetic Spider Silk for Thermal Management in Space

Completed Technology Project (2013 - 2017)



Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.2 Thermal Control Components and Systems
 - └ TX14.2.3 Heat Rejection and Storage

Target Destination

Foundational Knowledge